



# LENGTH-WEIGHT RELATIONSHIPS (LWRS) OF CORYPHAENA HIPPURUS (LINNAEUS, 1758) AND CORYPHAENA EQUESELIS (LINNAEUS, 1758) FROM SOUTH-EASTERN ARABIAN SEA

\*T. B. Rethesh<sup>1</sup> | Subal Kumar Roul<sup>2</sup> | A. R. Akhil<sup>1</sup> | E. M. Abdussamad<sup>1</sup>

<sup>1</sup>ICAR- Central Marine Fisheries Research Institute, Cochin, Kerala, India. (\*Corresponding Author)

<sup>2</sup>Puri Field Centre of ICAR-Central Marine Fisheries Research Institute, Puri, Odisha, India.

## ABSTRACT

This study reports the length-weight relationships of two dolphinfish species, namely *Coryphaena hippurus* (Linnaeus, 1758) and *C. equiselis* (Linnaeus, 1758) in the south-eastern Arabian Sea. Specimens in various length groups belonging to both the species were collected between April 2012 and May 2017 from Kerala waters, south-west coast of India. The fishes were caught by hook and line (hook no: VI-X) and drift gill net (mesh size: 90-160 mm). The length-weight relationships were established as  $TW = 0.0217FL^{2.786}$  ( $r^2 = 0.967$ ) for *C. hippurus* and  $TW = 0.0183FL^{2.891}$  ( $r^2 = 0.993$ ) for *C. equiselis*.

**KEYWORDS:** Dolphinfish, LWRs, *Coryphaena hippurus*, *C. equiselis*, Kochi, Kerala.

## INTRODUCTION:

The Coryphaenidae family comprises of only one genus *Coryphaena*, with two species, *Coryphaena hippurus* (Linnaeus, 1758) and *C. equiselis* (Linnaeus, 1758) which are commonly called as dolphinfishes. These are pelagic, highly migratory, oceanic species having a wide distribution in tropical and subtropical waters of the Pacific, Atlantic and Indian Oceans<sup>[1]</sup>. They generally occur along with large oceanic pelagic fishes and support important commercial fisheries in several regions<sup>[2,3]</sup>. Dolphinfishes are apex predators and feeds on fishes, crustaceans and molluscs. Occurrence of dolphinfishes in India is reported from all maritime states except West Bengal and the resource forms an important component of the fish landings of Gujarat, Daman and Diu, Kerala and Tamil Nadu<sup>[4]</sup>. Benjamin and Kurup<sup>[5]</sup> reported on the stock status of the species along Kerala Coast. The present study is aimed to provide a reliable estimate of length-weight relationship (LWRs) of two dolphin fish species landed along the Kerala waters, south-west coast of India.

## MATERIAL AND METHODS:

Specimens were collected from fishing harbours along the Kochi coast of Kerala, India (Fig. 1) from April 2012 to May 2017. They are mainly caught by hook and lines, drift gill nets and small quantity in troll lines. The fork length (FL) of the fish was measured from the most anterior part of the head to the end of the middle caudal fin rays using a digital vernier caliper with 0.1cm accuracy. The total weight (W) of the fish was recorded to the nearest 1g by an electronic weighing balance with 0.1 g accuracy. A total of 406 specimens of *C. hippurus* in the length range of 24-114 cm and a total of 76 specimens of *C. equiselis* in the length range of 20-51 cm were measured for the study. The length measurements more than 30 cm were taken by measuring tape and scale.

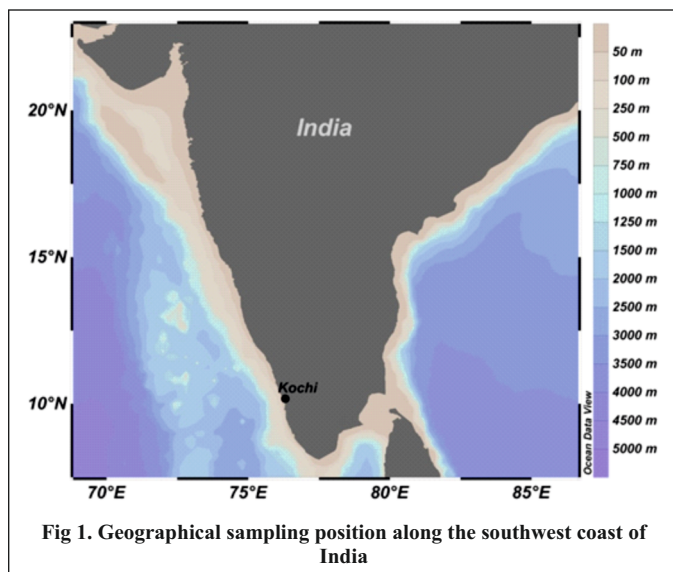


Fig 1. Geographical sampling position along the southwest coast of India

where TW: total weight (g), FL: fork length (cm) and  $a$  and  $b$  are regression parameters. The statistical significance level of co-efficient of determination ( $r^2$ ) and 95% confidence limits of parameters  $a$  and  $b$  (CL 95%) were estimated by least square linear regressions performed with the log transformed equation. Extreme outliers were removed from the regression analyses according to Froese<sup>[7]</sup>.

## RESULTS & DISCUSSION:

Present study is based on 406 specimens of *C. hippurus* and 76 specimens of *C. equiselis*. The detailed descriptive statistics and estimated parameters of LWRs for both the species are given in Table 1. The LWRs of both the species were highly significant ( $p < .001$ ) with coefficient of determination ( $r^2$ ) values greater than 0.960. The  $r^2$  value is 0.967 for *C. hippurus* and 0.933 for *C. equiselis*. The estimated  $b$  values in the LWRs for *C. hippurus* and *C. equiselis* were 2.786 and 2.891 respectively (Fig 2 & Fig 3). The logarithmic regression equations of *C. hippurus* and *C. equiselis* are represented as follows:

$$C. hippurus: \text{Log } TW = 0.0217 + 2.786 \text{ Log } FL$$

$$C. equiselis: \text{Log } TW = 0.0183 + 2.891 \text{ Log } FL$$

**Table 1.** Descriptive statistics and estimated length-weight relationship parameters of *C. hippurus* and *C. equiselis* collected from Kerala, south west coast of India from between April 2012 to May 2017

Species	N*	Length range FL(cm)	Weight range (g)	$a$	95% CI $a$	$b$	95% CI $b$	$r^2$
<i>Coryphaena hippurus</i> (Linnaeus, 1758)	406	24-114	190-13475	0.0217	0.0177-0.0266	2.786	2.736-2.836	0.967
<i>Coryphaena equiselis</i> (Linnaeus, 1758)	76	20-51	105-1585	0.0183	0.0140-0.0240	2.891	2.815-2.966	0.993

\*N, number of specimens studied;  $a$ , intercept of relationship;  $b$ , slope of relationship; CI, confidence interval;  $r^2$ , coefficient of determination.

The length-weight relationships (LWRs) were calculated using the equation<sup>[6,7]</sup>:  $TW = aFL^b$  and logarithmically transformed into  $\log TW = \log a + b \log FL$ ,

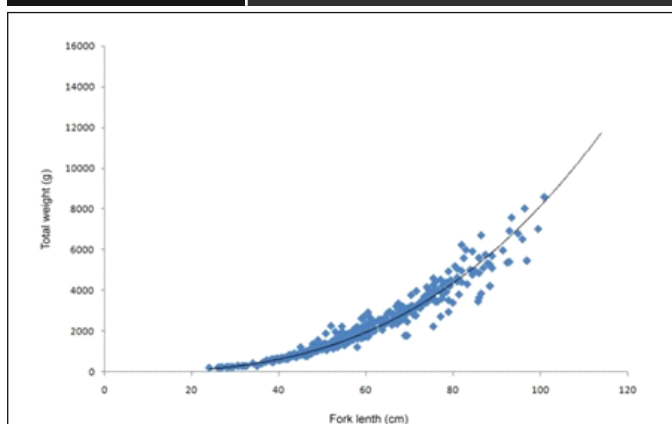


Fig 2. The length- weight relationship of *Coryphaena hippurus* from south-eastern Arabian Sea

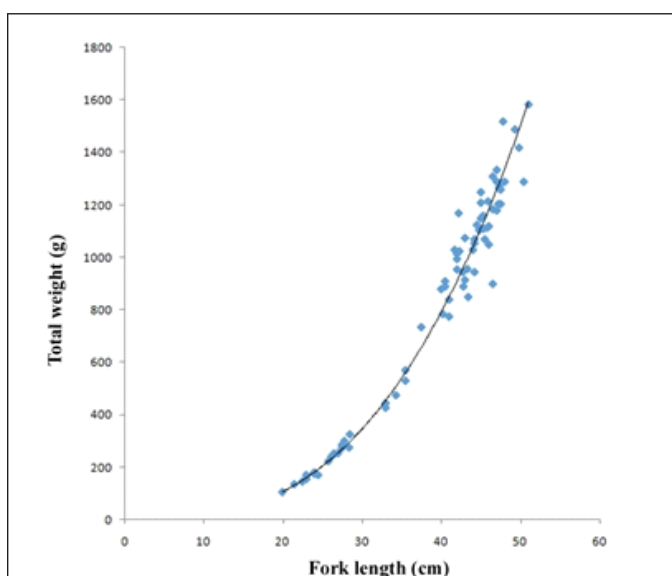


Fig 3. The length- weight relationship of *Coryphaena equiselis* from south-eastern Arabian Sea

In fisheries science, length-weight relationships (LWRs) are widely used to estimate weight and biomass where only length measurements are possible to record<sup>[7]</sup>. LWRs are also used in morphological comparisons between different species in same taxon and populations from different geographical area<sup>[8,9,10,11]</sup>. The LWR of an ideal fish follows the cube law where the value of exponent  $b$  will become exactly 3 if the fish retains the same shape and specific gravity and grows isometrically during their life time<sup>[12]</sup>. The estimated  $b$  values of LWRs are usually remained within the expected range of 2.5-3.5<sup>[7]</sup>.

The  $b$  values in the present study for *C. hippurus* and *C. equiselis* were 2.786 and 2.891 respectively, which substantiate the above statement. Information on length-weight relationship (LWRs) of *C. hippurus* from Indian waters is limited except for few<sup>[13]</sup>. He has reported the  $b$  value 2.1707 for *C. hippurus* after analyzing 348 specimens caught by long lines during exploratory survey along the west coast of India. This low  $b$  value may be due to inappropriate sampling from the highly selective gear such as long lines. The  $b$  values for both the species recorded in the present study were also comparable with the earlier authors from Central North Pacific waters<sup>[14]</sup> and Central Mediterranean waters<sup>[15]</sup>. This is the first study on LWR of *C. equiselis* in the region. Hence the present investigation provides the reliable estimate of LWRs parameters by covering wide size range for an extended time period which will be useful for fishery biologist for further studies from the studied area.

## CONCLUSION:

Landings of *C. hippurus* were observed throughout the year with peak landings during October to February whereas *C. equiselis* landed in few numbers along with *C. hippurus*. The results of the present study indicated that, the estimated  $b$  values in the LWRs for *C. hippurus* and *C. equiselis* were 2.786 and 2.891 respectively. This is also the first study on LWRs of *C. equiselis* from Indian waters. The landings of common dolphin fishes have been increasing steadily in the recent years due to heavy demand both from domestic and export markets.

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## Conflict of Interest:

There is no conflict of interest among the authors contributed to this publication.

## REFERENCES:

- I. Merten, W., Appeldoorn, R. and Hammond, D. 2014. Movement of dolphinfish (*Coryphaena hippurus*) along the US east coast as determined through mark and recapture data. *Fish. Res.*, 151: 114-121.
- II. Lasso, J. and Zapata, L. 1999. Fisheries and biology of *Coryphaena hippurus* in the Pacific coast of Colombia and Panama. *Sci. Mar.*, 63(3-4): 387-399.
- III. Olson, R. J. and Galvan-Magana, F. 2002. Food habits and consumption rates of common dolphinfish (*Coryphaena hippurus*) in the Eastern Pacific Ocean. *Fish. Bull.*, 100(2): 279-298.
- IV. Rajesh, K M and Rohit, Prathibha and Abdussamad, E M (2016) Fishery, diet composition and reproductive biology of the dolphinfish *Coryphaena hippurus* (Linnaeus, 1758) off Karnataka, south-west coast of India. *Indian Journal of Fisheries*, 63 (4). pp. 35-40.
- V. Benjamin, D. and Kurup, M. 2012. Stock assessment of dolphinfish *Coryphaena hippurus* (Linnaeus, 1758) off south-west coast of India. *J. Mar. Biol. Ass. India*, 54(1): 95-99.
- VI. Le Cren, E. D. (1951). The length weight relationship and seasonal cycle in gonad weight and condition in the perch (*Perca fluviatilis*). *Journal of Animal Ecology*, 20, 201-219.
- VII. Froese, R. (2006). Cube law, condition factor and weight-length relationships: history, meta-analysis and recommendations. *Journal of Applied Ichthyology*, 22, 241-253.
- VIII. Herath, H.M.T.N.B., Radampola, K. and Herath, S.S., 2014. Morphological variation and length weight relationship of *Oreochromis mossambicus* in three brackish water systems of Southern Sri Lanka. *International Journal of Research*, 2(2), pp.2311-2476.
- IX. Pathak, B.C. and Serajuddin, M.A., 2015. Comparative study of length-weight relationship and condition factor of lesser spiny eel, *Macrogathus aculeatus* (Bloach) from the different river basins of India. *World Journal of Fish and Marine Sciences*, 7(2), pp.82-86.
- X. Roul, S. K., Akhil, A. R., Rethesh, T. B., Prakasan, D., Ganga, U., Abdussamad, E. M., & Rohit, P. (2017a). Length-weight relationships of three fish species from Kerala waters, south-west coast of India. *Journal of Applied Ichthyology*, 00, 1-2.
- XI. Roul, S. K., Rethesh, T. B., Ganga, U., Abdussamad, E. M., Rohit, P., & Jaiswar, A. K. (2017b). Length-weight relationships of five needlefish species from Kerala waters, south-west coast of India. *Journal of Applied Ichthyology*. 2017; 00:1-3.
- XII. Wootton, R. J. (1990). *Ecology of teleost fishes*. Chapman and Hall, London. pp. 404.
- XIII. Vinod, K. M., Farejiya, M. K., Kiran, S. M., Sahu, K. C., & Rahulkumar, T. (2017). Observations on the food preferences, growth parameters and biological aspects of *Coryphaena hippurus* Linnaeus, 1758 exploited through the longline survey operations along the west coast of India. *International Journal of Fisheries and Aquatic Studies*, 5, 240-248.
- XIV. Uchiyama, J. H., & Boggs, C. H. (1988). Length-weight relationships of dolphinfish, *Coryphaena hippurus* and Wahoo, *Acanthocybium solandri*: Seasonal effects of spawning and possible migration in the Central North Pacific. *Marine Fisheries Review*, 68, 19-29.
- XV. Gatt, M., Dimech, M., & Schembri, P. J. (2015). Age, growth and reproduction of *Coryphaena hippurus* (Linnaeus, 1758) in Maltese waters, Central Mediterranean. *Mediterranean Marine Science*, 16, 334-345.